

Substituted 9a-N-{N'-[4-(sulfonyl)phenylcarbamoyl]} derivatives of 9-
-deoxo-9-dihydro-9a-aza-9a-homoerithromycin A and 5-O-
-desosaminyl-9-deoxo-9-dihydro-9a-aza-9a-homoerithronolide A

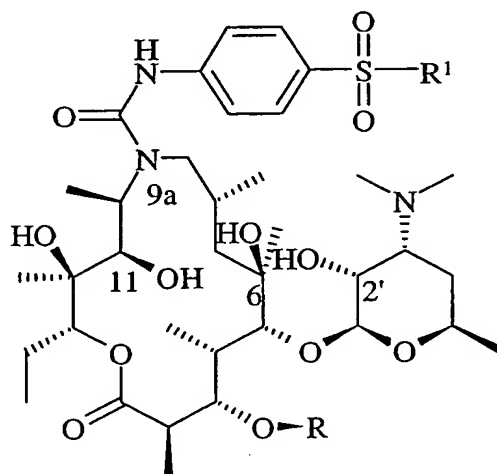
5 **Technical Field**

Int. Cl. C07H17/08, A61K31/71

Technical problem

10 The present invention relates to substituted 9a-N-{N'-[4-(sulfonyl)phenylcarbamoyl]} derivatives of 9-deoxo-9-dihydro-9a-aza-9a-homoerithromycin A and 5-O-desosaminyl-9-deoxo-9-dihydro-9a-aza-9a-homoerithronolide A, novel semisynthetic macrolide antibiotics of the azalide series having antibacterial activity of the general formula 1

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wherein R represents H or cladinosyl moiety, and R¹ represents chloro, amino, phenylamino, 2-pyridylamino, 3,4-dimethyl-5-isoxazolylamino and 5-methyl-3-isoxazolylamino group, to pharmaceutically acceptable addition salts thereof with

25 inorganic or organic acids, to a process for the preparation of the pharmaceutical compositions as well as to the use of pharmaceutical compositions obtained in the treatment of bacterial infections.

Prior Art

30 Erithromycin A is a macrolide antibiotic, whose structure is characterized by 14-membered macrolactone ring having carbonyl group in C-9 position. It was found by McGuire in 1952 [*Antibiot. Chemother.*, 2 (1952) 281] and for over 50 years it has been considered as a reliable and effective antimicrobial agent in the treatment of diseases caused by Gram-positive and some Gram-negative microorganisms. However, in an
35 acidic medium it is easily converted into anhydroerythromycin A, an inactive C-6/C-12 metabolite of a spiroketal structure [P. Kurath et al., *Experientia* 27 (1971) 362]. It is well-known that spirocyclisation of aglycone ring of erythromycin A is successfully inhibited by a chemical transformation of C-9 ketones or hydroxy groups in C-6 and/or C-12 position. By the oximation of C-9 ketones [S. Đokić et al., *Tetrahedron Lett.* 1967:
40 1945] and by subsequently modifying the obtained 9(E)-oxime into 9-[O-(2-methoxyethoxy)methyl] oxime] erythromycin A (ROXITHROMYCIN) [G. S. Ambrieres, Fr. Pat. 2,473,525, 1981] or 9(S)-erythromycylamine [R. S. Egan et al., *J. Org. Chem.* 39 (1974) 2492] or a more complex oxazine derivative thereof, 9-deoxy-11-deoxy-9,11-{imino[2-(2-methoxyethoxyethylidene)-oxy]-9(S)-erythromycin A (DI-
45 RITHROMYCIN) [P. Lugar i sur., *J. Crist. Mol. Struct.* 9 (1979) 329], novel semisynthetic macrolides were synthesised, whose basic characteristic, in addition to a greater stability in an acidic medium, is a better pharmacokinetics and a long half-time with regard to the parent antibiotic erythromycin A. In a third way for modifying C-9 ketones use is made of Beckmann rearrangement of 9(E)-oxime and of a reduction of
50 the obtained imino ether (G. Kobrehel i sur., U.S. Pat. 4,328,334, 1982.) into 11-aza-10-deoxy-10-dihydroerythromycin A (9-deoxy-9a-aza-9a-homoerythromycin A) under broadening the 14-member ketolactone ring into a 15-member azalactone ring. By reductive N-methylation of 9a-amino group according to Eschweiler-Clark process (G. Kobrehel et al., BE Pat. 892,397, 1982.) or by a preliminary protection of amino group
55 by means of conversion into the corresponding N-oxides and then by alkylation and

reduction [G. M. Bright et al., U.S. Pat., 4,474,768, 1984.] N-methyl-11-aza-10-deoxo-10-dihydroerythromycin A (9-deoxo-9a-methyl-9a-aza-9a-homoerithromycin A, AZITHROMYCIN) was synthesized, a prototype of azalide antibiotics, which, in addition to a broad antimicrobial spectrum including Gram-negative bacteria and intracellular microorganisms, are characterized by a specific mechanism of transport to the application site, a long biological half-time and a short therapy period. In EP A 0316128 (G. M. Bright et al.) novel 9a-allyl and 9a-propargyl derivatives of 9-deoxo-9a-aza-9a-homoerythromycin A are disclosed and in U.S. Pat. 4,492,688, 1/1985 (Bright G. M.) the synthesis and the antibacterial activity of the corresponding cyclic ethers are disclosed. In the J. Antibiotics 46 (1993) 1239 (G. Kobrehel et al.) there are further disclosed the synthesis and the activity spectrum of novel 9-deoxo-9a-aza-11-deoxy-9a-homoerythromycin A 9a,11-cyclic carbamates and O-methyl derivatives thereof.

According to the known and established Prior Art, 9a-N-{N'-[4-(sulfonyl)phenyl]carbamoyl}} derivatives of 9-deoxo-9-dihydro-9a-aza-9a-homoerithromycin A and 5-O-desosaminyl-9-deoxo-9-dihydro-9a-aza-9a-homoerithronolide A and pharmaceutically acceptable addition salts thereof with inorganic or organic acids, a process for the preparation thereof as well as the preparation methods and use a pharmaceutical preparations have not been disclosed as yet.

It has been found and it is object of the present invention that substituted 9a-N-{N'-[4-(sulfonyl)phenyl]carbamoyl}} derivatives of 9-deoxo-9-dihydro-9a-aza-9a-homoerithromycin A and 5-O-desosaminyl-9-deoxo-9-dihydro-9a-aza-9a-homoerithronolide A, novel semisynthetic macrolide antibiotics of the azalide series and pharmaceutically acceptable addition salts thereof with inorganic or organic acids may be prepared by reacting ammonia or substituted amine with 9a-N-[N'-[4-sulfonylphenyl]carbamoyl] derivatives of 9-deoxo-9-dihydro-9a-aza-9a-homoerithromycin A and 5-O-desosaminyl-9-deoxo-9-dihydro-9a-aza-9a-homoerithronolide A which are obtained by reacting of 9-deoxo-9-dihydro-9a-aza-9a-homoerithromycin A and 5-O-desosaminyl-9-deoxo-9-dihydro-9a-aza-9a-homoerithronolide A with 4-(chlorosulfonyl)phenylisocyanate and optionally by reacting the obtained 9a-N-{N'-[4-(sulfonyl)phenyl]carbamoyl}}

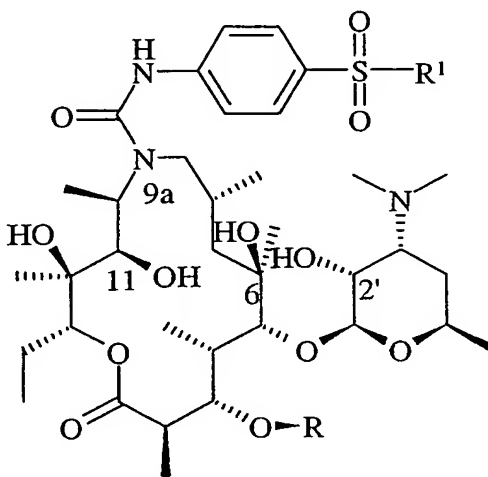
derivatives of 9-deoxo-9-dihydro-9a-aza-9a-homoerithromycin A and 5-O-desosaminyl-
-9-deoxo-9-dihydro-9a-aza-9a-homoerithronolide A with inorganic and organic acids.

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Technical Solution

It has been found that novel substituted 9a-N-{N'-[4-(sulfonyl)phenylcarbamoyl]}
derivatives of 9-deoxo-9-dihydro-9a-aza-9a-homoerithromycin A and 5-O-desosaminyl-
-9-deoxo-9-dihydro-9a-aza-9a-homoerithronolide A of the general formula 1, wherein R
represents H or cladinosyl group and R¹ represents chloro group,

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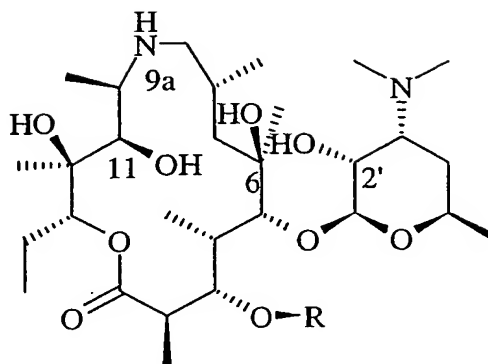


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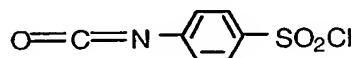
may be prepared by reacting 9-deoxo-9-dihydro-9a-aza-9a-homoerithromycin A and 5-
-O-desosaminyl-9-deoxo-9-dihydro-9a-aza-9a-homoerithronolide A of the general
formula 2,

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2

wherein R represents H or cladinosyl group, with 4-(chlorosulfonyl)phenylisocyanate
 110 formula 3,



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after that the compounds of general formula 1 were obtained, in which R has previous
 115 meaning, and R¹ represents Cl, by reaction of the compounds general formula 1
 respectively, wherein R represents H or cladinosyl group and R¹ represents Cl, with
 ammonia or substituted amines general formula 4, wherein R² represents H, phenyl
 group, 2-pyridyl group, 3,4-dimethyl-5-isoxazolyl group or 5-methyl-3-isoxazolyl
 group,



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in toluene, xylene or some other aprotic solvent, at a temperature of 0°C to 110°C.

Pharmaceutically acceptable acid addition salts which also represents an object of the
 present invention, were obtained by reaction of substituted 9a-N-{N'-[4-
 125 -(sulfonyl)phenylcarbonyl]} derivatives of 9-deoxo-9-dihydro-9a-aza-9a-homoerithro-
 mycin A and 5-O-desosaminyl-9-deoxo-9-dihydro-9a-aza-9a-homoerithronolide A with
 an at least equimolar amount of the corresponding inorganic or organic acid such as
 hydrochloric acid, hydroiodic acid, sulfuric acid, phosphoric acid, acetic acid,
 trifluoroacetic acid, propionic acid, benzoic acid, benzene sulfonic acid, methane sulfonic

130 acid, lauryl sulfonic acid, stearic acid, palmitic acid, succinic acid, ethylsuccinic acid, lactobionic acid, oxalic acid, salicylic acid and similar acids, in a solvent inert to the reaction. Addition salts are isolated by evaporating the solvent or, alternatively, by filtration after a spontaneous precipitation or a precipitation by the addition of a non-polar cosolvent.

135 Substituted 9a-N-{N'-[4-(sulfonyl)phenyl]carbamoyl} derivatives of 9-deoxo-9-dihydro-9a-aza-9a-homoerithromycin A and 5-O-desosaminyl-9-deoxo-9-dihydro-9a-aza-9a-homoerithronolide A of the general formula 1 and pharmaceutically acceptable addition salts with inorganic or organic acids thereof possess an antibacterial activity *in vitro*.

140 Minimal inhibitory concentration (MIC) is defined as the concentration which shows 90% growth inhibition, and was determined by broth dilution methods according to National Committee for Clinical Laboratory Standards (NCCLS, M7-A2) protocols. Final concentration of test substances were in range from 64 to 0.125 µg/ml. MIC levels
145 for all compounds were determined on panel of susceptible and resistant Gram positive bacterial strains (*S. aureus*, *S. pneumoniae* and *S. pyogenes*) and on Gram negative strains (*E. coli*, *H. influenzae*, *E. faecalis*, *M. catarrhalis*).

Test substances from Example 3 to 7 were active on susceptible strains of *S. pyogenes* (MIC 2 to 8 µg/ml), and on susceptible strains of *S. pneumoniae* (MIC 0.5 to 8 µg/ml).
150 Substances from Example 3 and 4 showed strong antimicrobial activities on *S. pyogenes* iMLS resistant strain (MIC 2 µg/ml).

The obtained results for substances from Example 3 to 7 expressed as MIC in mg/ml suggest a potential use thereof as sterilization agents of e.g. rooms and medical instruments and as industrial microbial agents e.g. for the protection of wall and
155 wooden coatings.

Process for the preparation of 9a-N-{N'-[4-(sulfonyl)phenyl]carbamoyl} derivatives of 9-deoxo-9-dihydro-9a-aza-9a-homoerithromycin A and 5-O-desosaminyl-9-deoxo-9-dihydro-9a-aza-9a-homoerithronolide A of this invention is illustrated by the following
160 Examples which should in no way be construed as a limitation of the scope thereof.

Example 1

9-Deoxo-9-dihydro-9a-N-([4-(chlorosulfonyl)phenyl]carbamoyl)-9a-aza-9a-
165 -homoerithromycin A

A mixture of 1.35 g (1.84 mmol) 9-deoxo-9-dihydro-9a-aza-9a-homoerithromycin A and 0.40 (1.84 mmol) 4-(chlorosulfonyl)phenylisocyanate and 30 ml dry toluene was stirred 1 hour at the temperature 0°-5°C. The reaction mixture was evaporated at
170 reduced pressure to dryness to give crude 9-deoxo-9-dihydro-9a-N-([4-(chlorosulfonyl)phenyl]carbamoyl)-9a-aza-9a-homoerithromycin A. The pure product was obtained, where from by chromatography the crude product on a silica gel column using solvent methylene chloride.

MS(ES⁺) m/z = 794.

Example 2

5-O-Desosaminyl-9-deoxo-9-dihydro-9a-N-([4-(chlorosulfonyl)phenyl]carbamoyl)-9a-
180 -aza-9a-homoerithronolide A

Analogously to the process disclosed in Example 1, from 1.95 g (2.0 mmol) 5-O-desosaminyl-9-deoxo-9-dihydro-9a-aza-9a-homoerithronolide A and 0.43 g (2.0 mmol) 4-(chlorosulfonyl)phenylisocyanate in 30 ml dry toluene crude product was obtained, wherefrom by chromatography on silica gel column using methylene chloride as a solvent. Pure 5-O-desosaminyl-9-deoxo-9-dihydro-9a-N-([4-(chlorosulfonyl)phenyl]-
185 carbamoyl)-9a-aza-9a-homoerithronolide A was obtained.

MS (ES⁺)m/z = 794.

Example 3

9-Deoxo-9-dihydro-9a-N-([4-(aminosulfonyl)phenyl]carbamoyl)-9a-aza-9a-
190 -homoerithromycin A

The solution of 1.35 g (1.84 mmol) 9-deoxo-9-dihydro-9a-aza-9a-homoerithromycin A and 0.4 g (1.84 mmol) 4-(chlorosulfonyl)phenyl isocyanate in 30 ml dry toluene was

195 stirred about 1.0 hour at the temperature 0°- 5°C. In the reaction mixture 5.0 ml (4.55 g;
61.5 mmol) 23 % water solution of ammonia was added and the reaction mixture was
stirred about 30 minutes at room temperature. The crude product was filtered,
wherefrom by column chromatography on silica gel using solvent system methylen-
chloride : methanol = 9 : 1. Pure 9-deoxo-9-dihydro-9a-N-{[4-(aminosulfonyl)phenyl]-
carbamoyl}-9a-aza-9a-homoerithromycin A was obtained.

200 IR (KBr)/cm⁻¹ = 1727, 1638, 1593, 1552, 1126, 1013.

¹H NMR (500 MHz; CDCl₃/δ) = 4.41 (1H, H-1'), 4.76 (1H, H-1''), 4.00 (1H, H-3),
3.41 (1H, H-5), 3.20 (3H, 3''-OCH₃), 2.89 (1H, 4''), 2.50 (6H, 3'-N'(CH₃)₂), 2.26
(1H, H-2''a), 1.51 (1H, H-2''b), 1.29 (1H, H-8), 0.96 (3H, 10-CH₃), 0.89 (3H 4-CH₃),
205 0.80 (3H, H-15).

¹³C NMR (500 MHz; CDCl₃/δ) = 175.6 (C-1), 155.5 (9a-N₂CONH), 101.9 (C-1'),
95.2 (C-1''), 84.1 (C-5), 78.3 (C-3), 48.8 (3''-OCH₃), 44.5 (C-2), 27.6 (C-8), 19.9 (8-
CH₃), 9.2 (10-CH₃), 11.1 (C-15).

210 MS (ES⁺) m/z (%) = 933.

Example 4

215 9-Deoxo-9-dihydro-9a-N-{N'-[4-(phenylaminosulfonyl)phenyl]carbamoyl}-9a-aza-9a-
-homoerithromycin A

Analogously to the process disclosed in Example 3, from 1,35 g (1,84 mmol) 9-deoxo-
-9-dihydro-9a-aza-9a-homoerithromycin A, and 0,4 g (1,84 mmol) 4-
-(chlorosulfonyl)phenyl isocyanate, 1,0 ml (11,0 mmol) aniline in 30 ml dry toluene 0,8
220 g pure 9-deoxo-9-dihydro-9a-N-{N'-[4-(aminosulfonyl)phenyl]carbamoyl}-9a-aza-9a-
-homoerithromycin A was obtained with following spectral data.

IR (KBr)/cm⁻¹ = 1727, 1638, 1593, 1552, 1126, 1013.

225 ^1H NMR (500 MHz; CDCl_3/δ) = 4.45 (1H, H-1'), 4.76 (1H, H-1''), 4.01 (1H, H-3), 3.38 (1H, H-5), 3.22 (3H, 3''-OCH₃), 2.90 (1H, 4''), 2.50 (6H, 3'-N'(CH₃)₂), 2.26 (1H, H-2''a), 1.52 (1H, H-2''b), 1.27 (1H, H-8), 0.90 (3H, 10-CH₃), 0.89 (3H 4-CH₃), 0.79 (3H, H-15).

230 ^{13}C NMR (500 MHz; CDCl_3/δ) = 179.0 (C-1), 155 (9a-N $\underline{\text{C}}$ ONH), 103.8 (C-1'), 95.8 (C-1''), 84.7(C-5), 79.0 (C-3), 50.0 (3''-OCH₃), 46.5 (C-2), 27.9 (C-8), 20.4 (8-CH₃), 9.2 (10-CH₃), 11.3 (C-15).

MS (ES^+) m/z (%) = 1009.

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Example 5

9-Deoxo-9-dihydro-9a-N-{N'-[4-(2-pyridylaminosulfonyl)phenyl]carbamoyl}-9a-aza-9a-homoerithromycin A

240 Analogously to the process disclosed in Example 3, from 1.35 g (1.84 mmol) 9-deoxo-9-dihydro-9a-aza-9a-homoerithromycin A, 0.4 g (1.84 mmol) 4-(chlorosulfonyl)phenyl isocyanate and 0.70 g (5.2 mmol) 2-aminopyridine in 30 ml dry toluene 0.5 g pure 9-deoxo-9-dihydro-9a-N-{N'-[4-(2-pyridylaminosulfonyl)phenyl]carbamoyl}-9a-aza-9a-homoerithromycin A was obtained with following spectral data.

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IR (KBr)/ cm^{-1} = 1727, 1638, 1593, 1552, 1126, 1013.

^1H NMR (500 MHz; CDCl_3/δ) = 4.41 (1H, H-1'), 4.75 (1H, H-1''), 4.00 (1H, H-3), 3.38 (1H, H-5), 3.21 (3H, 3''-OCH₃), 2.89 (1H, 4''), 2.50 (6H, 3'-N'(CH₃)₂), 2.27 (1H, H-2''a), 1.48 (1H, H-2''b), 1.27 (1H, H-8), 0.89 (3H, 10-CH₃), 0.88 (3H 4-CH₃), 0.79 (3H, H-15).

250

^{13}C NMR (500 MHz; CDCl_3/δ) = 175.6 (C-1), 155.4 (9a-N $\underline{\text{C}}$ ONH), 101.9 (C-1'), 95.1 (C-1''), 84.0 (C-5), 78.1 (C-3), 48.8 (3''-OCH₃), 46.5 (C-2), 27.6 (C-8), 19.9 (8-CH₃), 9.1 (10-CH₃), 11.1 (C-15).

255

MS (ES^+) m/z (%) = 1014.

260

Example 6

9-Deoxo-9-dihydro-9a-N-{N'-[4-(3,4-dimethyl-5-isoxazolylaminosulfonyl)phenyl]-
carbamoyl}-9a-aza-9a-homoerithromycin A

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Analogously to the process disclosed in Example 3, from 1.35 g (1.84 mmol) 9-deoxo-9-dihydro-9a-aza-9a-homoerithromycin A, 0.4 g (1.84 mmol) 4-(chlorosulfonyl)phenyl isocyanate and 0.41 g (3.67 mmol) 5-amino-3,4-dimethylisoxazole in 30 ml dry toluene 1.5 g pure 9-deoxo-9-dihydro-9a-N-{N'-[4-(3,4-dimethyl-5-isoxazolylaminosulfonyl)-
phenyl]carbamoyl}-9a-aza-9a-homoerithromycin A was obtained.

270

MS (ES⁺) m/z (%) = 1028.

Example 7

9-Deoxo-9-dihydro-9a-N-{N'-[4-(5-methyl-3-isoxazolylaminosulfonyl)phenyl]-
carbamoyl}-9a-aza-9a-homoerithromycin A

275

Analogously to the process disclosed in Example 3, from 1.35 g (1.84 mmol) 9-deoxo-9-dihydro-9a-aza-9a-homoerithromycin A, 0.4 g (1.84 mmol) 4-(chlorosulfonyl)phenyl isocyanate and 0.36 g (3.67 mmol) 3-amino-5-methylisoxazole in 30 ml dry toluene 0.40 g pure 9-deoxo-9-dihydro-9a-N-{N'-[4-(5-methyl-3-isoxazolylaminosulfonyl)-
phenyl]carbamoyl}-9a-aza-9a-homoerithromycin A was obtained with following spectral data.

280

¹H NMR (500 MHz; CDCl₃/δ) = 4.42 (1H, H-1'), 4.75 (1H, H-1''), 4.01 (1H, H-3), 3.39 (1H, H-5), 3.20 (3H, 3''-OCH₃), 2.89 (1H, 4''), 2.50 (6H, 3'-N'(CH₃)₂), 2.24 (1H, H-2''a), 1.48 (1H, H-2''b), 1.28 (1H, H-8), 0.90 (3H, 10-CH₃), 0.87 (3H 4-CH₃), 0.79 (3H, H-15).

285

¹³C NMR (500 MHz; CDCl₃/δ) = 175.8 (C-1), 155.6 (9a-N₂CONH), 101.7 (C-1'), 95.8 (C-1''), 84.0 (C-5), 78.3 (C-3), 48.9 (3''-OCH₃), 45 (C-2), 27.8 (C-8), 20.2 (8-CH₃), 9 (10-CH₃), 11.3 (C-15).

MS (ES⁺) m/z (%) = 1014.

Example 8

5-O-Desosaminy-9-deoxo-9-dihydro-9a-aza-9a-homoerithronolide A

Analogously to the process disclosed in Example 3, from 1.15 g (2.0 mmol) 5-O-desosaminy-9-deoxo-9-dihydro-9a-aza-9a-homoerithronolide A, 0.43 g (2.0 mmol) 4-(chlorosulfonyl)phenyl isocyanate and 5.0 ml (4.55 g; 61.5 mmol) 23 % water solution of ammonia in 30 ml xylene 0.60 g pure 5-O-desosaminy-9-deoxo-9-dihydro-9a-N-[4-(aminosulfonylphenyl)carbamoyl]-9a-aza-9a-homoerithronolide A was obtained with following spectral data.

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¹H NMR (500 MHz; piridin/δ) = 8.16, 7.93, 7.93, 7.5 (1H, fenilni), 5.60 (1H, H-13) 5.1 (1H, H-1'), 4.41 (1H, H-5) 4.30 (1H, H-3), 3.61 (1H, H-5'), 3.49 (1H, H-2'), 3.02 (1H, H-2), 2.61 (1H, H-3'), 2.21 (6H, 3'-N(CH₃)₂), 2.36 (1H, H-14a), 1.70 (1H, H-4'a), 1.87 (1H, H-14b), 1.69 (1H, H-4) 1.52 (1H, H-4'b), 1.58 (3H, 2-CH₃), 1.01 (3H, H-15).

310

¹³C NMR (500 MHz; piridin/δ) = 178 (C-1), 156.7 (NH₂CONH), 144.8, (fenil.), 133.2 (fenil.), 131.5, 129.3, 127.6, 115.3, (CH, fenil.), 103.3 (C-1'), 75.0 (C-13) 75.4 (C-3), 69.9 (C-5'), 69.2 (C-2') 68.0 (C-5), 65.4 (C-3') 45.6 (C-2), 40.3 (3'-N(CH₃)₂), 39.1 (C-4), 23.2 (C-14), 29.2 (C-4'), 16.7 (2-CH₃), 11.4 (C-15).

315

MS (ES⁺) m/z (%) = 775.

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Example 9

5-O-Desosaminyl-9-deoxo-9-dihydro-9a-N-{N'-[4-(phenylaminosulfonyl)phenyl]-carbamoyl}-9a-aza-9a-homoerithronolide A

325 Analogously to the process disclosed in Example 3, from 1.15 g (2.0 mmol) 5-O-desosaminyl-9-deoxo-9-dihydro-9a-aza-9a-homoerithronolide A, 0.43 g (2.0 mmol) 4-(chlorosulfonyl)phenyl isocyanate and 0.4 ml (0.419 g, 4.4 mmol) aniline in 30 ml dry toluene 0.70 g pure 5-O-desosaminyl-9-deoxo-9-dihydro-9a-N-{N'-[4-(phenylaminosulfonyl)phenyl]carbamoyl}-9a-aza-9a-homoerithronolide A was obtained with
330 following spectral data.

^1H NMR (500 MHz; CDCl_3/δ) = 4.35 (1H, H-1'), 3.86 (1H, H-3), 3.57 (1H, H-5'),
3.31 (1H, H-2'), 2.67 (1H, H-2), 2.5 (1H, H-3'), 2.30
(6H, 3'-N(CH₃)₂), 1.96 (1H, H-14a), 1.70 (1H, H-4'a),
335 1.56 (1H, H-14b), 1.30 (1H, H-4'b), 0.93 (3H, H-15).

^{13}C NMR (500 MHz; CDCl_3/δ) = 175.8 (C-1), 105.3 (C-1'), 75.4 (C-3), 69.8 (C-5'),
68.9 (C-2') 64.6 (C-3') 44.7 (C-2), 39.6 (3'-N(CH₃)₂),
20.9 (C-14), 29.8 (C-4'), 10.4 (C-15).

340 MS (ES⁺) m/z (%) = 851.

Example 10

5-O-Desosaminyl-9-deoxo-9-dihydro-9a-N-{N'-[4-(2-pyridylaminosulfonyl)phenyl]-carbamoyl}-9a-aza-9a-homoerithronolide A

345 Analogously to the process disclosed in Example 3, from 1.15 g (2.0 mmol) 5-O-desosaminyl-9-deoxo-9-dihydro-9a-aza-9a-homoerithronolide A, 0.43 g (2.0 mmol) 4-(chlorosulfonyl)phenyl isocyanate and 0.4 g (4.2 mmol) 2-aminopyridine in 30 ml dry toluene 0.80 g pure 5-O-desosaminyl-9-deoxo-9-dihydro-9a-N-{N'-[4-(2-pyridylaminosulfonyl)phenyl]carbamoyl}-9a-aza-9a-homoerithronolide A was obtained with
350 following spectral data.

^1H NMR (500 MHz; CDCl_3/δ) = 8.30, 7.64 7.38, 7.64 (1H, aminopiridin), 4.34 (1H, H-1'), 3.84 (1H, H-3), 3.58 (1H, H-5'), 3.31 (1H, H-2'), 2.63 (1H, H-2), 2.6 (1H, H-3'), 2.29 (6H, 3'-N(CH₃)₂), 1.94 (1H, H-14a), 1.71 (1H, H-4'a), 1.55 (1H, H-14b), 1.29 (1H, H-4'b), 0.92 (3H, H-15).

^{13}C NMR (500 MHz; CDCl_3/δ) = 141.5, 140.8, 114.5, 114.1 (aminopiridin), 105.4 (C-1'), 75.3 (C-3), 69.9 (C-5'), 68.9 (C-2') 64.6 (C-3') 44.7 (C-2), 39.6 (3'-N(CH₃)₂), 20.9 (C-14), 29.9 (C-4'), 10.4 (C-15).

MS (ES^+) m/z (%) = 852.

Example 11

5-O-Desosaminy-9-deoxo-9-dihydro-9a-N-{N'-[4-(3,4-dimethyl-3-isoxazolylaminosulfonyl)phenyl]carbamoyl}-9a-aza-9a-homoerithronolide A

Analogously to the process disclosed in Example 3, from 1.15 g (2.0 mmol) 5-O-desosaminy-9-deoxo-9-dihydro-9a-aza-9a-homoerithronolide A, 0.43 g (2.0 mmol) 4-(chlorosulfonyl)phenyl isocyanate and 0.45 g (4.0 mmol) 5-amino-3,4-dimethylisoxazole in 30 ml dry toluene 0.75 g pure 5-O-desosaminy-9-deoxo-9-dihydro-9a-N-{N'-[4-(3,4-dimethyl-3-isoxazolylaminosulfonyl)phenyl]carbamoyl}-9a-aza-9a-homoerithronolide A was obtained with following spectral data.

MS (ES^+) m/z (%) = 870.

Example 12

5-O-Desosaminy-9-deoxo-9-dihydro-9a-N-{N'-[4-(5-methyl-3-isoxazolylaminosulfonyl)phenyl]carbamoyl}-9a-aza-9a-homoerithronolide A

Analogously to the process disclosed in Example 3, from 1.15 g (2.0 mmol) 5-O-desosaminy-9-deoxo-9-dihydro-9a-aza-9a-homoerithronolide A, 0.43 g (2.0 mmol) 4-(chlorosulfonyl)phenyl isocyanate and 0.39 g (4.0 mmol) 3-amino-5-methylisoxazole in 30 ml dry toluene 0.7 g pure 5-O-desosaminy-9-deoxo-9-dihydro-9a-N-{N'-[4-(5-

-methyl-3-isoxazolylaminosulfonyl)phenyl]carbamoyl}-9a-aza-9a-homoerithronolide A
385 was obtained with following spectral data.

^1H NMR (500 MHz; CDCl_3/δ) = 4.36 (1H, H-1'), 3.87 (1H, H-3), 3.56 (1H, H-5'),
3.32 (1H, H-2'), 2.65 (1H, H-2), 2.48 (1H, H-3'), 2.32
390 (6H, 3'-N(CH₃)₂), 1.95 (1H, H-14a), 1.70 (1H, H-4'a),
1.55 (1H, H-14b), 1.30 (1H, H-4'b), 0.90 (3H, H-15).

^{13}C NMR (500 MHz; CDCl_3/δ) = 105.6 (C-1'), 74.6 (C-3), 69 (C-5'), 69.3 (C-2') 64.6
(C-3') 44 (C-2), 40.1 (3'-N(CH₃)₂), 21.4 (C-14), 30.2
395 (C-4'), 10.8 (C-15).

MS (ES⁺) m/z (%) = 856.